Notebook Series -- Notebooks by Experimenters Other Than Edison
Kinetophone and Kinetoscope Experiments -- L. E. Briggs Books
Notebook, N-13-09-17

This notebook was used by Leroy E. Briggs during September 1913-January 1914 for experimental notes on an automatic film developing machine. The book consists primarily of a daily account of Briggs's activities, including experiments with new or improved parts made for the machine. There are occasional references to work on the home projecting kinetoscope and to the "other book" (N-13-05-22 [not selected]). The notes indicate that Briggs's work on the developing machine was overseen by Edison and Miller Reese Hutchison. There are occasional notations regarding Edison's opinions or suggestions. The notes also indicate that William W. Dinwiddie, Absalom M. Kennedy, Charles W. Luhr and James W. Ramsay were involved in similar work. The front cover is labeled "Automatic Machine for Developing, Fixing and Drying Motion Picture Film. L.E. Briggs SO. 3300." The pages are irregularly numbered. Approximately 75 pages have been used.

56700

Acme Co.,
MFG. STATIONERS,
96 JOHN ST.
AND
19 PLATT ST.
NEW YORK.

L. E. Briggs

Thomas A. Edison

Laboratory, Orange. NJ.

Motion Picture Film
Developing Machine

S.O. # 3300.

3300 Wed. Sept 17, 13 -1

Afternoon.

Cleaned out the developing room.

Developing trays have been held up by wooden wedges. Hooks or something more permanent should be used.

Ordered the blower which is to replace the one Dinwiddie took away.

Mr. Luhr is making new sprockets of monel metal:
12 monel metal
24 brass to be nickeled

Ramsey says he found 4 ft. shrinkage in 400 ft of film run through developing machine.

This is not confirmed by my experiments.

2300 Thurs. Sept 18, 13

Washed the reservoirs for developer, hypo, and glycerine and got 3 rubber corks for same.
Washed glass funnels and glass supply wells.

Ordered 3 pieces of 1/4 glass tubing - each 60" long. These are to lead the developer etc from reservoirs to ~~to~~ trays.

Made wood brackets to hold the bucket carriers and also monel metal trips for buckets.

Experimented with bucket trip.

3300 Fri. Sept 19, 13.

Put up 3 wood brackets, set monel metal trips in proper positions and connected up cords. Adjusted buckets.

Connected glass reservoirs with glass wells by means of glass by-cocks and rubber tubing.

The small spray nozzels on the washer are stopped up and the washer as a whole is too crowded. The water splashes over the steel driving chains and on the floor.

Ordered 6 ft of 1/4" rubber tubing and 3 red incandescent lamps.

Started to alter the washer.

3300 Sat. Sept. 20, 13

I saw Winwiddie this morning and I brought down the cooling tank for developer-tank circulating water. Also a kerosene-mercury thermostat.

3300 Monday Sept 22, 13

Got monel-metal calatogues from Simpson.

I ordered 2 sheets of monel metal ~~30 x 60~~ 32 x 96" .021" thick and ~~1 gross of No 2 56 Threads per inch of monel metal.~~

Pat Brady telephoned to Biddle Hardware Co but they could not supply us with the monel metal screws and we had to take two sheets 32"x96" .021" thick which are promised in 3 days.

Mr. Luhr ordered 72 steel collars and ~~and~~ 72 small set screws to be nickel plated at the Works.

I made a sketch of water jacket and another of washer trays. Gave these to Mr. Luhr.

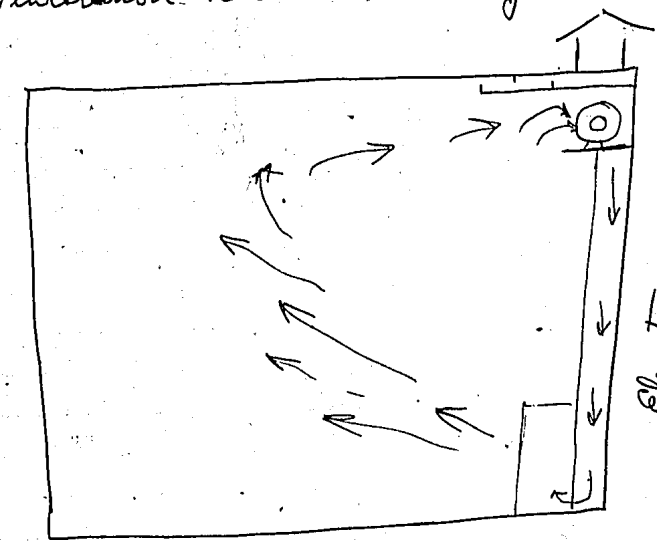
3300 Mon. Sept. 22, 13.

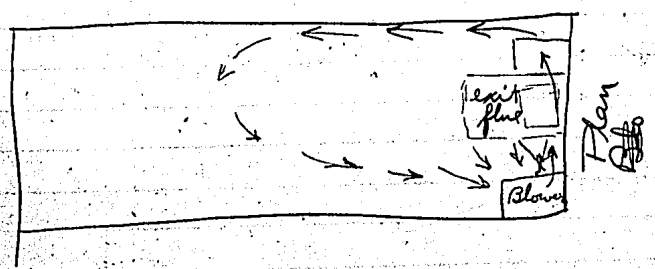
Put up the new Sirocco Fan – Am. Blower Co.
Fan No 6297 A.
Westinghouse Elec & Mfg Co.
Pittsburg. Pa. U. S. A.
Direct Current Motor Shunt Wound.
1/6 H.P. 110 volt.
.72 amp., 1600 R.P.M.
Stayton No. So 466754
Serial No. 994401
This blower is used to circulate the air in the room.

The blower on the ~~blo~~ drying tower overheats.
Type R.R. volts 110
Amps 2
Size Rev. 3400
No. 6-5-37
B.F. Sturtevant Co
Boston Mass.

3300 Mon. Sept. 22, 13

Traced air currents in the room by means of smoke. Ventilation Blower running.





3300 Tues. Sept. 23, 13

8:30 AM Room Temperature 62°
9:00 64°

9:30 Blower for dryer Tower is too hot to run.

I took off this blower and turned over to Mr. Kennedy to have repaired.

I find that all chain sprockets are loose on the shafts. The set screws are too small to hold. All these must be drilled out for a larger set screw.

I have decided to put the chains back of the hanger planks and thereby keep them dry and away from water.

Took down the supporting wood beams for sprockets shafts etc. Had Mr Mudd saw plaser to allow chain to run on back side.

(15)

3300 Tues. Sept. 23, 13

Told Mr. Mudd how I wanted a filter box between window and the ventilation blower.

Had Mr. Liber make the pipe connection between the blower flange and the filter box. This connection is of sheet metal and it has six slots on its circumference. These slots or air-ports permit air from the room to be drawn in by the fan when the weather is very cold.

Got brass wood screws to replace irons which were rusting in bronze castings.

Got small brass set screws also to replace iron ones.

Got a rod of drill-rod for new driving shafts which are about 1" longer than old ones.

3300 Wed. Sept 24, 13

Changed the electric lighting circuits for ruby-lights, white room lights, blower, etc in order that each may be turned on or off independent of each other.

Got the slotted pipe connection between the ventilation blower and the filter-box. Helped the carpenter to put it on, and I instructed the carpenter how to make filter-box.

Kennedy's man cleaned up the blower for Drying Tower but it still heats up. I had him drill some ½ holes in the motor case as an aid to ventilation but the motor continues to heat.

Night - 7:30 - 12:30.

3300 Wed. Sept. 24, 13

Got the chain-sprockets from Mr. Duhr, and also necessary screws that I would need.

Cut drillrod into correct lengths for shafts. Spotted positions of set screws on shafts and filed flat spots for same.

Connected and set up shafts, sprockets and chains on lower hanger in ~~drug~~ Film drying Tower.

Same for hanger for Washer. Chains now run outside of washer and are no longer exposed to water.

CHJ

3300 Thurs. Sept. 25, 13

Gave the blower of the Film drying Tower to Mr. Luhr inorder to have him pipe some air from fan chamber through the motor case for cooling purposes. He found one bearing in bad condition. I tested the armature for grounds but it didn't have any.

~~Got~~ Eastmans regular formular of developer from Mr. Ward.

Developer. #16

Sodium Sulphite	3 lbs 5 oz
" Carbonate	1 " 9 "
Metal	180 grains
Hydroquinone	8 oz
Bromide Potash	1 oz 63 grains
Citric Acid	408 grains
Potas Metabisulph	2 oz
Aqua	10 gal

65 %

#375 grains = 1 oz.

3300 Thurs. Sept 25, 13.

Got 8 more chain sprockets from Mr. Luhr.

Ordered Perfection Paper fastener for connecting pieces of film. Charged to #2888.

Connected up the sprockets chains and shafts on hangers for developer and hypo trays.
The chain at the Hypo tray was so rusted that it could not run around the small sprockets. Soaked it in kerosene oil.

Thurs. Night.

Tried small film feeding motor and let it run until 10 P.M. Chains were connected as far as the washer.
Altered electric wiring in room.

3300 Fri. Sept 26, 13

Cleaned and oiled chains.
Connected up all shafts with chains.
Threaded the machine with film and started to change old sprocket ribbs for new sprocket rolls.

Fixed electric light receptacles to hold ruby lights with shades.

Gave Mr. Lyman some bottles to hold developer which he will mix.

Received the paper fastener which is used to join pieces of film.

Monel metal came in today but Mr. Lubs says he can not make cooling jacket for several days.

3300. Sat 2 7, 13

Tried blower which Mr. Luhr fixed for me. It runs very good now.

Made some gauges to assist in locating the sprocket rolls for film.

3300 . Mon. Sept. 29, 13

Put on all sprocket-rolls and lined them up inorder to make the film run freely.

These rolls and the driving chains work well.

Started to put tower blower in position but had to return it to Lubr because the machinists had not put it together as it was originally.

Started to set up the Cooling water reservoir. Gave it to the tinsmith to have position of overflow changed.

Tinsmith is making my washer tray and is putting a water jacket on the developing tray.

3300 Tues. Sept 30, 1913

Put up blower for Film drying Tower. It runs very good now.

Fixed pipe connections for water supply. One valve supplys sprayer to rinse off developer. Another valve is for general supply to cooling water reservoir etc.

Gave Mr. Mudd a sketch for a stand to support the cooling water jacket ~~supply~~ Put cooling water reservoir in position on this stand. Connected up small motor to run the circulating pump which maintains a constant difference of head in the reservoir.

Experimented with the Kerosene-oil-Mercury Thermostat inorder that I could adjust the light of mercury at center of tube for 65°.

Put up a new tray etc. on the Washer.

3300 ~~Sept~~ Wed. Oct 1, 1913

Most of today was spent in making the electrically operated valve which permits ice water to run into the cooling water reservoir when its temperature becomes over 65°. The electric circuit is made in the kerosene-oil-mercury thermostat.

Got the developing tray with its new cooling water jacket.

3300 Thurs. Oct 2, 13.

Put up drain troughs, trays stabber tubing etc and tried out

Will try to get desired Temperature regulation tomorrow.

~~F 4.5~~
F 6.3
~~F 9.~~
~~F 12~~
F 18
F 25

This film was then left out in my dark room for 15 min all red lights on. When developed the film was fogged showing that the room is too light.

3300 Fri. Oct. 3, 1913

Calibrated the solution reservoirs and wells.

Painted the Washer Chamber.

Experimented with cooling water apparatus. Had to elevate large tank under to increase hydrostatic head. Developer tray had to be taken down and repaired twice because of leaks.

Had a cover made for small ice-box.

3300

Sat. Oct. 4, 1913

Got a M.P. Camera, film, telescope, tripod etc.

Set up in yard and made a test exposure.

F 4.5
F 6.3
F 9
F 12
F 18
F 25

This film was then left out in my dark room for 15 minutes — all red lights out. When developed, the film was fogged showing that the room is too light. (test film was developed at Small Film Plant).

CHIT

3300 Mon. Oct 6, 1913

Finished alteration on the Washer Chamber. All the sheet metal work is now finished.

Data and Results of a preliminary test of machine — reservoirs, wells, and trays were filled with water instead of their respective solutions.

Time 3 PM Mon. Oct 6, 13
Outside Temperature 74° F
Room temperature 76° F
Av. temp of cooling water 55° F
" " " developer in tray 70° F

water temp	devel. temp.
55°	70°
55°	70°
55°	70°
55°	70°

By passing the ventilation air supply over a block of ice, the room temperature — gradually became constant at 74° F.

3300 Moscow Oct 6, 13.

Time interval required for the film to travel 6 ft.

Test.		
1st	5 min	58.8 sec
2	5	55.8
3	5	53.8
4	5	51.5
5	5	50 0
6	5	47.0
7	5	51.4
8	5	50.2
Total 8	40 min	418.5 sec
average	5 min	52.3 sec.

5 min 52.3 sec = 5.87 minutes

$\frac{6 \text{ ft}}{5.87 \text{ min}}$ = 1.022 ft per min.

or 61.32 ft per hr

or 1472. ft per 24 hrs.

SE 3800 Mon. Oct 6, 13.

Rate of developer supply:

300 cc. devel. in well at start
2500 cc " " reservoir " "

After 35 minutes 16 seconds in operation:

250 cc devel in well at finish
1800 cc " " reservoir " "

38 buckets during this interval.
750 cc " " "

$\frac{750}{38}$ = 19.74 cc per bucket.

$\frac{38}{35.27}$ = 1.077 bucket per minute.

$\frac{750}{35.27}$ = 21.264 cc per minute

or 1276 cc per hr.
or 0.337 gallons per hr.
or 5.497 gallons per 1000 ft.

480 grains per ounce
16 oz per lbs.
Avoirdupois weight

437.5 grains = 1 ounce
16 oz or 7000 grains = 1 pound.

4 quarts = 231 cu. in = 1 gallon U.S.

1 gallon U.S = 3.785 44 liters
1 liter = .2642 gallons U.S.

1 gallon water at 62° F. weighs 8.3356 lbs.
" " " " " " 133.4 oz.

one fluid ounce is 1/128 part of 1 U.S gallon
128 fluid ounces = 1 gallon U.S.

33.00

Eastmans #16

Mon. Oct 6, 13

		Prices in bulk	Cost for 10 gal solution
3lb 5oz	Sulphite Soda	5lb for $.85	$ 0.563
1lb 9oz	Carbonate Soda	5 lbs " $.65	.203
180 grain	Metol	1 lb " $4.95	.124
8 oz	Hydrochinnon	5 lb " $3.50	.350
1oz 63gr.	Bromide Potas	1 lb. " .48	.034
400 gr	Citric acid	1 lb " .58	033
2 oz	Potas Metabisulfite	1 lb " .50	063
10 gal.	water.		
			$ 1.373

Cost per gallon $ 0.137
Cost of developer per 1000 feet film developed $ 0.753

Hypo Solution.

2 lbs hypo in 1 gallons U.S.

Hardener. 2 oz per gallon. " "

Hardener { Acetic acid 15 oz
Sulphite of Soda 2 oz
Alum 1 oz.

Hypo costs about 3¢ per lb.

3300 Tues. Oct 7 1913

#1 First test film showing still object.

A group of miscellaneous objects were set up and photographed. Arc lights in the Laboratory were used.

The best amount of exposure for light conditions was determined by a trial piece of film which was then developed in the dark room of the H.P.K. film plant.

A piece 4 feet long, 2 ft of which had been exposed to the red light in my dark room for 45 minutes, was also developed at the Home P.K. Film Plant. The entire 4 feet of this film came out perfectly clear, showing the my ruby lights were perfectly safe and that film could safely be opened and handled in my dark room without danger of "fogging"

C.S.I.

4 ft 22½ in = 5.875 ft

33
5.875
38.875 ft. passed same point in 37 min 16.6 sec or 37.27 min

38.875 / 37.27 = 1.043 ft film per min →

3300 Tues. Oct 7, 1913

Data readings taken at end of test – after 33 feet of negative passed through the developer tray.

Room temperature	70° F
Cooling water "	56° F
Developer "	68° F

37 minutes 16.6 seconds between start of film entering developer and end of film leaving developer.

4 ft 22½ inches of film always in developer tray (during this test)

Amounts of solutions left in reservoirs:

Developer res.	2700 cc
Hypo	3150 cc
Glycerine	2100 cc

By mistake, the hypo valve was closed during most of this run. Consequently the last end of the negative was not thoroughly fixed due to the hypo in the tray becoming weak. This film looks very promising.

Mr. Brettison – a photographer at Brons.

3300 Wed. Oct 8, 1913

In order to get negative film ~~under~~ as nearly as possible under conditions of standard practice, I telephoned to

Mr. Horace G. Plympton, Manager of Brons' Studio to get his concent for permission that I be allowed to make an exposure with my camera set beside the studio camera.

I met Mr. Pheiss, the Head Camera man.

Took 180 feet of two scenes

Returned to the Laboratory Wed night and worked until 2 AM developing etc this negative.

CSS

Humidity of air at 73° is .82
find humidity of this air after
it is heated to 84° F.

Vapor pressure of water vapor at 73° = 26.98 cm Hg.

35.49 at 80°F
23.33 at 70°F
12.16 diff.
.3
3.648
23.33
26.98 cm Hg at 73°F.

Vapor pressure of water vapor at 84°F = 42.31 cm

52.55 at 90°F
35.49 at 80°F
17.06
.4
6.824
35.49
42.31 cm Hg.

$\therefore \frac{.82 \times 26.98}{42.31} = .52$ relative Humidity at 84°F.

3300 Wed. Oct 9, 1913

Development of negative which I took at the Bronx Studio.
Wed. Oct 8, 1913
No. 1582 or "What does it profit a man?
~~150~~ 170 feet film.
Readings at finish of developing:

Room temperature	74°F
Room humidity (Dry 75° - Wet 71°)	82
Cooling water temperature	56° F
Developer temperature	71° F
Hypo "	72° F
Humidity out doors (dry 73° Wet 69°)	82
Film drying Tower	
Temperature	84°F
Humidity (dry 84° - wet 73°) no table - have calculate.	

Length of film.
in developer tray 5 ft 10½ inches.
in Hypo tray 7 ft 2 in.

33 OD Wed. Oct 8, 1913

cont'd

159 minutes 55 seconds — the time interval required for ~~150~~ 170 ft of film to pass one point.

$\frac{170 \text{ ft}}{159.9 \text{ min}} = 1.631$ ft per minute

∴ each individual exposure was in developer solution 3.602 min.

$\frac{5.875 \text{ ft}}{.938 \text{ per min}} = 6.27$ minutes

and in the Hypo solution

$\frac{7.666}{1.631} = 4.70$

$.938$

8.17 minutes.

Last end of film left the developer tray at 12:07 AM. and reached the reel at 1:51 AM or 104 minutes latter.

$1.04 \times .938 = 97\frac{1}{2}$ feet of film between rear end of developer tray and the winding on film reel.

1

2909
~~7300~~

Thurs. Oct 9, 13.

Work on Home P.K.

See other book.

Coll

3300 Friday Oct 10, 1913.

Work on reports etc.

3300 Sat. Oct 11, 1913.

Had Reis send order to Mr. Farrel. I saw Farrel personally and he had an order to Mr. Jamison made which I carried with me.

Mr. Jamison developed a short ~~test~~ piece of positive and then had 170 ft pieces of positive ~~made~~ printed only, not developed from my negative which I photographed at the Bronx and afterward developed in the ~~automatic~~ machine.

The test was printed No 3. but it was decided to give the positive a little more time, making it No 5.

Mr. Jamison then gave me 1 gal of Edinol stock developer.

I mixed 4 gallons of hypo solution — 12 lbs hypo to 4 gallons water. To this I added 60 cc formaldehyde.

[65]

3300 Sat. Oct 11, 1913.

5 min 47 sec to travel 5.875 ft.
5 " 50 " " " "

film set to 5 ft 1" in devel
this gives 5 minutes in devel.

first end of film entered developer
at 3:30:10 PM.

The chain broke when about 2 ft
film had passed into developer tray.

This was repaired at 5 PM.

Night

3300 Sat Oct 11, 1913.

Returned to Lab at 7:30 PM. started film motor to test chain. The shaft which carries the last driving sprocket and also the large sprocket gear ran badly out of true. Consequently the chain climbed off the sprocket gear and the same chain which broke before broke again in a different position.

Repaired the chain with two new pins and put in two new shafts.

Tested out again. Chain broke again. I find that the chains are stretching. Consequently the chain becomes loose enough to climb up upon the sprocket, hence subjecting the machine to great strain.

Will have Mr. Luhr make some idlers to take up slack.

Suggestion: the shafts should be 3/8" dia and the chain sprockets should be larger — about 4" dia.

2909 Mon. Oct 13, 13

Worked on Home Kinetoscopes

2909 Tues. Oct 14, 13

Morning — worked on Home Kinetoscopes

3300 Afternoon 19½

Put up idlers on chains and put in two new shafts.

Weather report of New York Time for
Wed. Oct 15, 13 – Thursday Times.

48° F	at 8 AM.	
55° F	at 8 PM	
63° F	at 3:50 PM	Max.
64	Humidity at 8 AM	
60	" " 8 PM	
29.94	Barometer at 8 AM	
29.82	" 8 PM.	

3300 Wed Oct 15, 13.

Start of Test:

Room temp.	64
Outside temp	57°F
Cooling water temp	63 ~~68~~° F
developer temp.	~~66~~ °F
outside Humidity	61° 51°
room humidity	63°-57°

11:45:45 Start } in developer
2:18:00 end }
2:33:45 out of hypo.
2:56:10 ~~outside~~ dryer
3:43 finish

After test

~~Outside temperature~~	68°
Room Temp	70°
Outside ~~temp~~ 68°-59°	59
Cooling water temp	66°F
developer temp	66°F
drying room temp. ~~75~~	80°F
" " humidity 75-63	51
Room " " 72-64	65

Film in developer 6 ft long.
166 ft film went through

[75]

3300 Thurs. Oct 16, 13

Cont'd

At the start of this ~~test~~ the room was very cold; and cooling water and developer were also too cold.

The ~~room~~ regulator for the room temperature regulation was set at 70° inorder to heat the room, and the tap water which was nearly at the right temperature was allowed to replace the ice-tempered water previously used for cooling water in the jacket.

The temperature readings etc were more nearly representative of conditions than when the conditions at start are considered.

Outdoor temperature	68°F
" Humidity	.60
Room Temperature	70°F
Cooling water in jacket	66°F
developer temperature	66°F
Av. temps in Drying Tower	68°F
" Humidity " " "	.60

Because of an accident in the drying tower at the beginning of the test, the film ran off one sprocket roll and as a result the film made only four passes through the tower while formally (8) eight passes were used.

Also because of some trouble with the steam radiator, the heat in the drying tower was on only at the very finish of the test.

But since the day was bright and clear with fairly dry air, the film had plenty of time to dry.

Nov. 3, 13.

Emerson Electric Co.
Shunt
1800 R.PM - 1/20 H.P.
110 volt .7 amp.
Direct current motor used to elevate cooling water to the higher head.

C C K Dynamo & Motor Co
Belleville N.J.
1/12 HP Volts 110
15 RPM Amp. 0.8
Direct Current to wind up the film.

B F Sturtevant Co. Boston Mass
Size 2 110 volts
2 amp.
Shunt current 3400 R.P.M
Fan Size B. 300 cu ft.

Westinghouse Elec Co. Pittsburg.
Direct Current motor
Shunt wind; constant speed, continuous duty.

1/6 HP 110 volts
.72 amp 1300 RPM

3300 Thurs. Dec. 4, 13.

Mr. Edison called Mr. Hutchison and I and wanted to know what had been done upon the automatic machine for developing the motion picture film

We showed him the last positive which I had photographed at the Bronx and the negative of which had also been developed in this machine.

Mr Edison asked what capacity the machine had. 1 foot per minute.

He then suggested using them in multiple units. That is putting six film sprocket rolls on each shaft.

Mr. Hutchison said that I would develope another film and then Mr. Edison could see the machine in operation.

Form 9

Received from Film Dept. No.

FILM No.	Library No.	Class	P. O.	SUBJECT	IF TITLES ONLY	Quan.	Length	TOTAL	STATE IF Original, Foreign or Duplicate Negative Studio, Master or Other Positive
				Mystery Dance Express			50		
				#3 Roll					
				Finish Editing					
				Cut					

For Req. No.

Date 12-10 1913. Received by C. E. Briggs For Lab.

8300

Dec 13, 13.

Start

Room Temp. 63

Outside Temp 41

Cooling water 58

Level Temp 60

outside Humidity

noon humidity 63-57

67-60

Start 11:25:00

12:45 00

84 feet film in 80 minutes

or 1.05 ft per min.

#3300 Dec. 15, 13.

Pointers from Bob Kent, Sunday evening.

For Ball Bearings:

S. Bretz Co. N.Y. Ind. Eng.

Auburn Ball Bearing Co
Rochester, N.Y. Ind. Eng.

Temperature Regulation:

The Bristol Co Waterbury, Conn. Ind. Eng.

Thwing Instrument Co.
447 North Fifth St
Philadelphia, Pa.
200 Fifth Av. N.Y.C. Ind. Eng.

C. J. Tagliabue
Manufacturing Co.
1800 to 88. 33 [illegible] St Brooklyn, N.Y. Ind. Eng.

Best to vary the temp of coils or quantity of air?

Blowers:

Leiman Bros 62 & John St N.Y.C. Ind. Eng.

Connersville Co.
Connersville. In.
Wilkins was on the G. trip.

Drill rod was 7/32" dia.
Proposed shafts to be about 5/16 to 3/8"

3300 Dec. 15, 13.

Refrigeration:
Carbondale Machine Co
30 Church St. NYC.
Mention Bob when writing to Henry Torrance about passing air over Brine coils.

Chains:
James M. Dodge.
Link Belt Co Phil.
State problems and ask if Dodge chain will work. mention Bob.

Gears:
Brown & Sharpe.

Mr. Edison saw the machine Saturday and made the following suggestions:
1 Increase capacity by speeding the film 10 times or making it 10 ft per min. Hutch suggested 30 ft.
2 Developer tray to be in one length. Machine to run full length of building if necessary.
3. Developer to flow in near exit of film, thus having the weakest developer

3. When the film is twisted in order to bring it into trays of different planes, the film is subject to greater stress at its edges and therefore is likely to stretch unevenly which may show up in projection as buckling.

4. The emulsion side next to the sprocket rolls is less likely to be scratched than when emulsion side is next to the tank because the relative motion between film and sprocket is zero while the emulsion side next to tank rubs along the entire length of tank.

acting upon the film at start and finishing up with strong developer.

Thoughts to be remembered:

1 All sprocket rolls should be fast to shaft and shaft to turn loosely in Ball bearings clear from all bindes.

2 Rapidly moving film, punched holes acting as little buckets will carry considerable solution with it from the trays. Hence is it not best to have weakest solution near exit of film, strong solution entering with film?

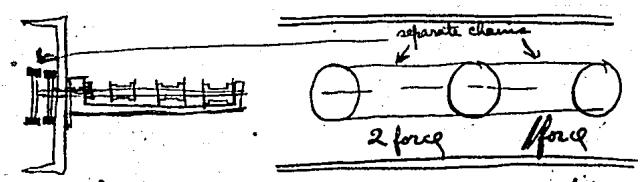
In order to test different metals in solutions of hypo and developer, I cut into small strips the following and put them in bottles of these solutions

Aluminum
Copper
Monel Metal.

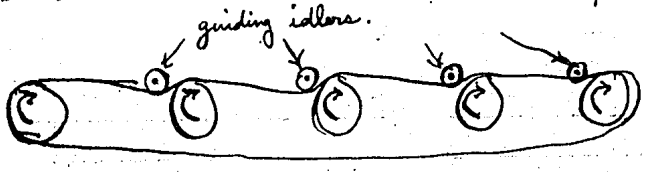
Notes on Warners drying machine:

1. Eyelet fasteners seem good. Quicker than clipless paper fastener.

2. small chain drives 4" sprockets. Upper row of sprocket rolls are all drivers, all supported from 6" channel, and casting



I think one heavy chain would be best:



3. Warners uses the commercial film sprocket but I think my special one is better.

4. Warners uses a wooden cylinder weighted at the bottom of film loops to act as take ups. weight complete 2 oz.

33.00

Mon. Dec. 15, 13.

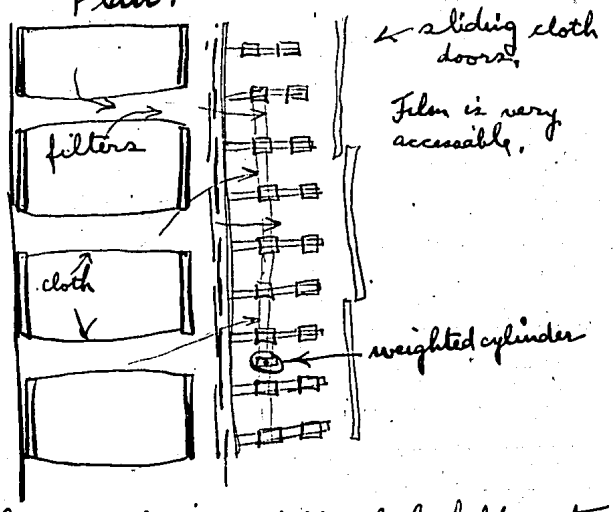
Monel metal or nickel alloy.
Biddle Hardware Co
160 Chambers St.

Temperature Regulator Thermostat
Am. Radiator Co.
140 W. 42d St N.Y.C.

No. 1 L H B H. Delivery Sirocco Am.
Blowers $60.00. used for ventilation and temperature regulation.

5 Notes on Warners Dryers:

Plans.



6. Warner has a felt wheel, kept wet with dropping water to wash off the glycerine from the celluloid side.

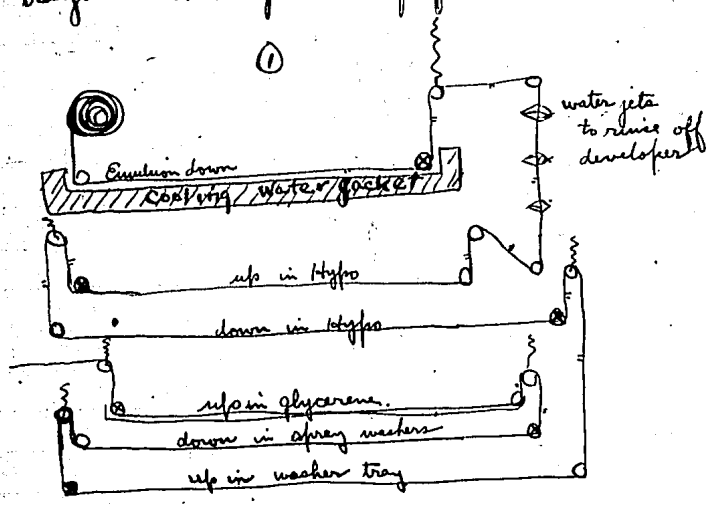
7. Jet of compressed air blows excess of water off leaving the celluloid side dry and clean.

8. Warner can dry in 15 minutes to 1 hr. He was running it at 20 ft per min drying 700 ft in 35 minutes.

800 ft in 30 minutes now
250 feet for 10 ft speed.

33.00 Mon. Dec. 15, 13.

Suggestions for arrangement of trays and passes of film:

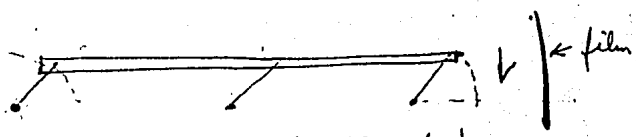


film passes over 21 sprocket rolls.

A time in developer
2A time in Hypo
2A time in Washer
A time in Glycerene.
6A length in machine

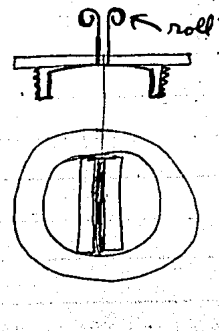
Suggestion:

Solution trays to be supported upon link motion in order that tray can be lowered for quick loading of machine:



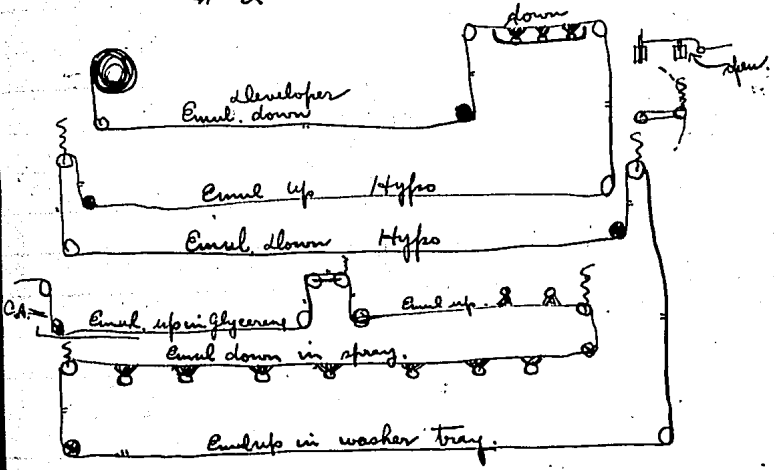
film risers must be placed far enough to one side to permit this side motion of tray.

Suggestion for a sprinkler to be used on underside of film.



3300 Mon. Dec. 16, 13.

2

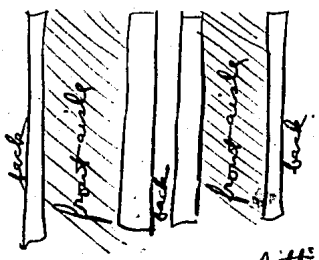


21 Sprocket rolls.

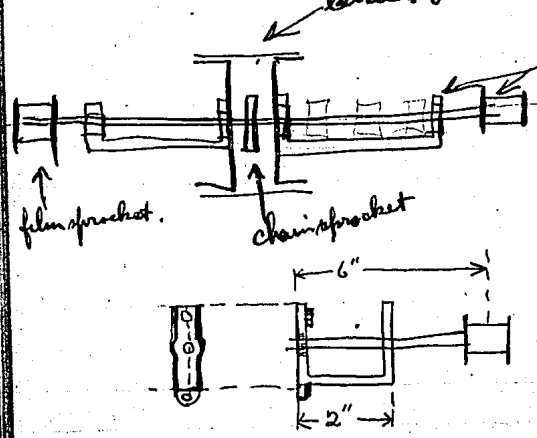
A length in developer
2A " in Hypo
2½A length in washer.
½ A length in glycerene

6 A length in machine.

suggestion for compounding two machines;



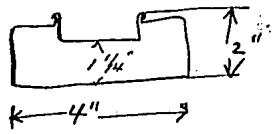
Plan view of four machines — run by two attendants



#3300 Tues. Dec. 16, 13.

Measurements from old machine,

Developer tray
6 ft 2 3/4 x 2" x 3/4"



Hypo tray.
7 ft 4 1/2 in x 2" x 3/4" with snake groove.

Measurement of solutions.
16 teeth on small sprockets
60 " on large sprocket with crank.
one bucket per min. (about)

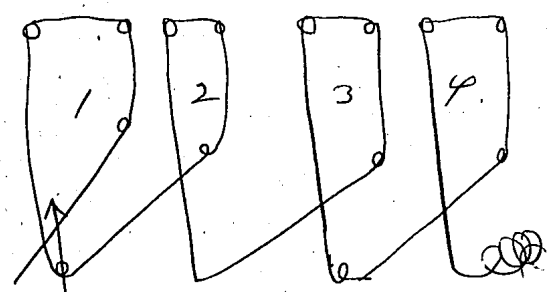
Glycerine Tray 4 ft 2" x 2" x 3/4"

178 in or 15 ft in washer.
seven jets of water.

Industrial Instrument Co.
Foxboro, Mass.

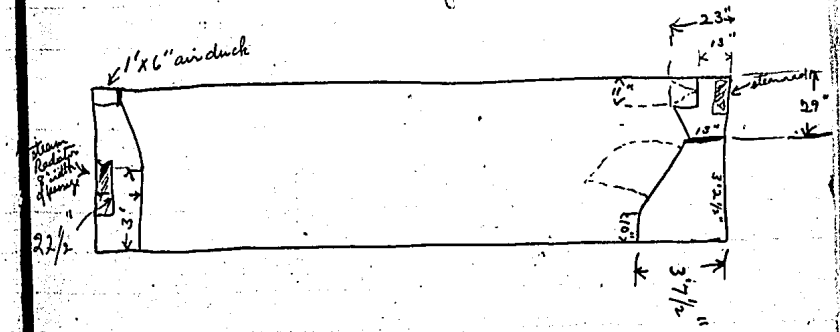
Recording Hygrometer

Size 8" One Rev of chart 24 hrs
Enamel Case and nickel Plated Ring
$88.00 -10% = $79.20 including
100 charts, Bottle ink etc.
Range between freezing and
boiling points of water.



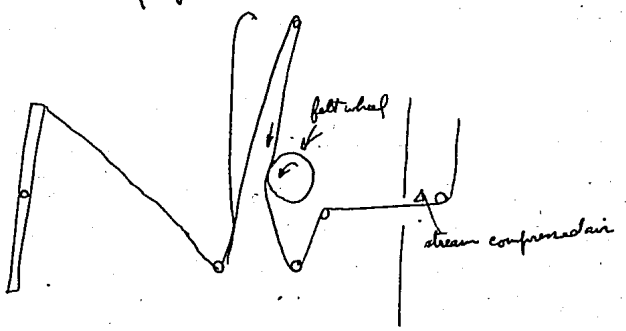
18 ft × 4 = 72 ft in dryer.

Room 15'-6" high.
5'7" wide
24'10" long

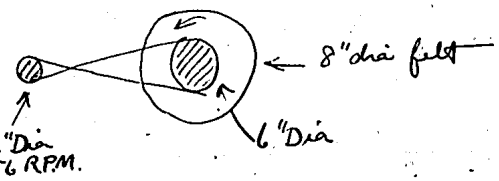


Dec 22.

Felt wheel to remove glycerine from back of film.



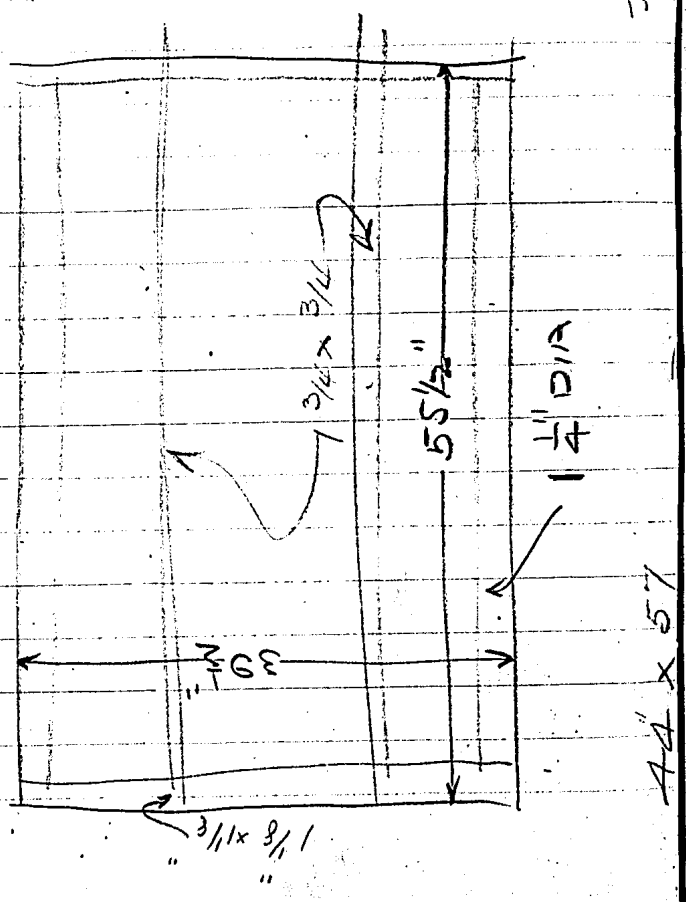
Film is traveling about 10 to 20 ft per min.



$\frac{56}{3} \times \pi \times \frac{8}{12} = 39.1$ ft per min surface speed.

relative surface speed $39.1 - 10 = 29.1$ ft".

Hearsack
12-19-13

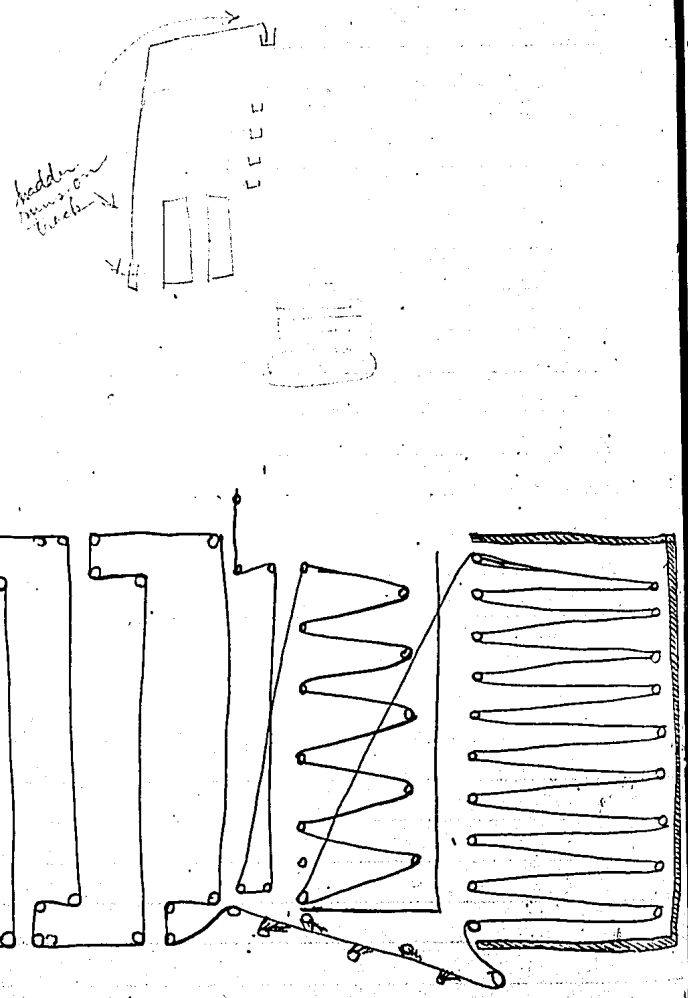


3300 Sat. Dec. 20, 13.

Makers of Wooden Tanks.
A. J. Corcoran Inc.
Tank Manufacturers
Jersey City, N.J.

In washing films, Jamison ~~uses~~ a stream of compressed air which bubbling up from the bottom of the tanks scours off all hypo with the minimum cost for water.

C[45]

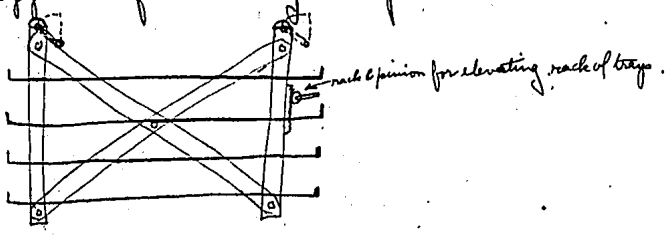


3300
3300

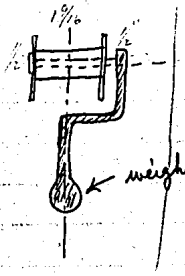
Mon. Dec. 22, 13.
Tues. Dec. 30, 13,

Calculations:
10 ft per minute.
Combined developer trays 60 ft.
4 trays 15 feet long.

Suggestion for raising trays:



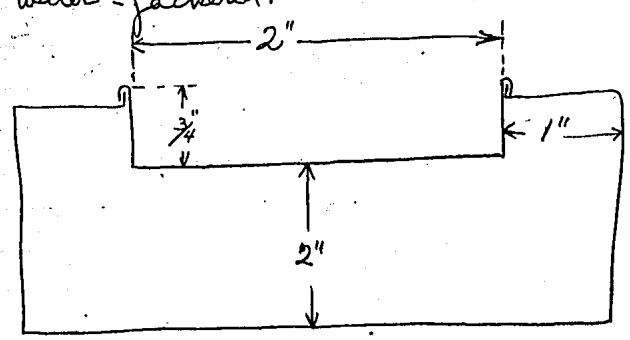
Sprocket weight;



1 5/8
2 1/8

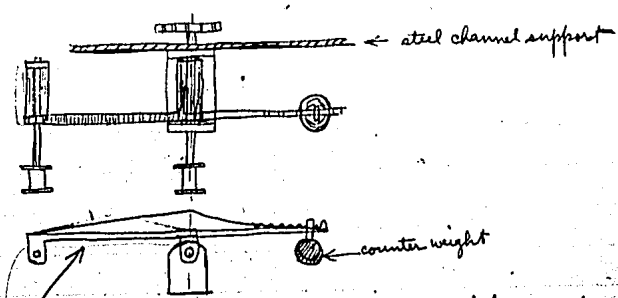
3300 Wed. Dec. 31, 13.

Cross section of Developer Trays.
water-jacketed.



one monel sprocket weighs 100 grams ✓
equals 0.22 lbs.

Detail of take-up. Hangers.



make the rocker arm as light as possible - not heavier than necessary to get good casting.

7.48 gal = 1 cu ft

(3½)

$$\frac{(52" + 52") \times 66" \times 3.5 \times 7.48}{1728} = 104 \text{ gal}$$

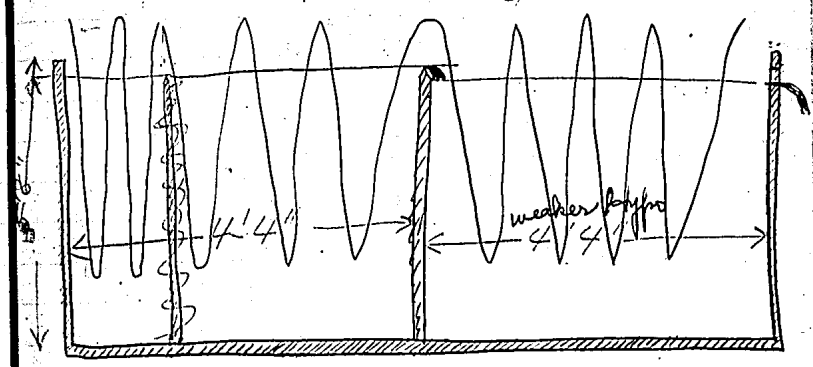
(4)

$$\frac{150.4 \times 66 \times 4 \times 7.48}{1728} = 119 \text{ gal}$$

$$\frac{(12 + 19 + 36) \times 66 \times 4 \times 7.48}{1728} = 76\tfrac{1}{2} \text{ gal}$$

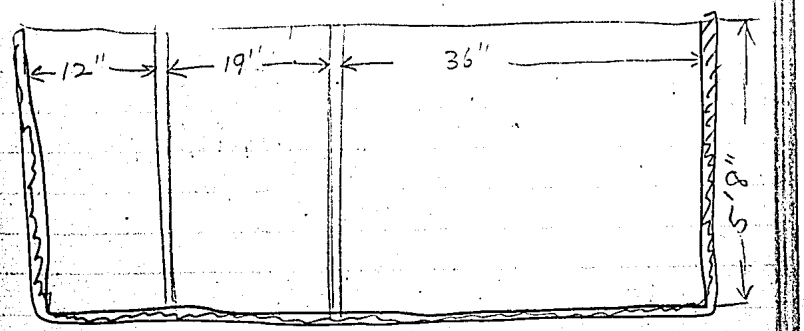
3300 Wed. Dec. 31, 13.

Details of Hydro Tanks 3½ to 4" wide



depth of solution 5'6".

Water Tanks



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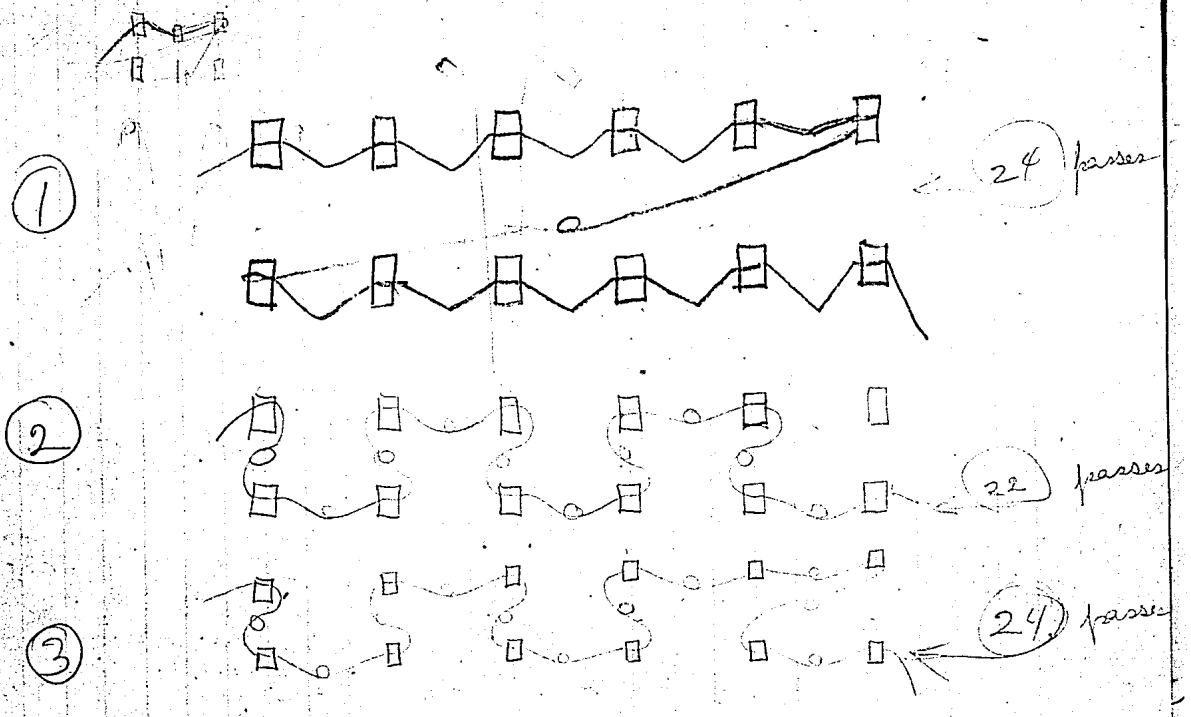
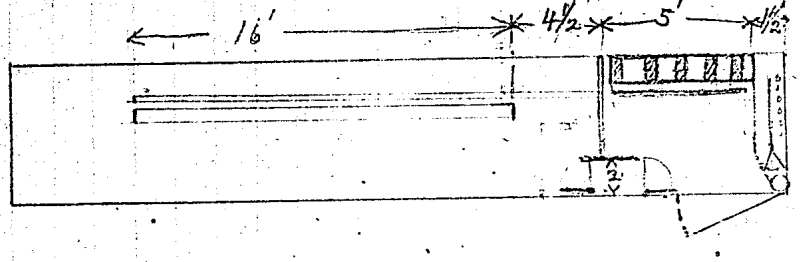
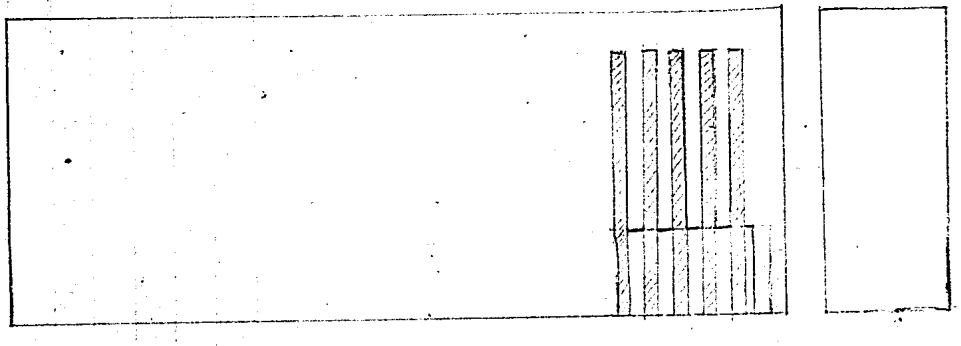
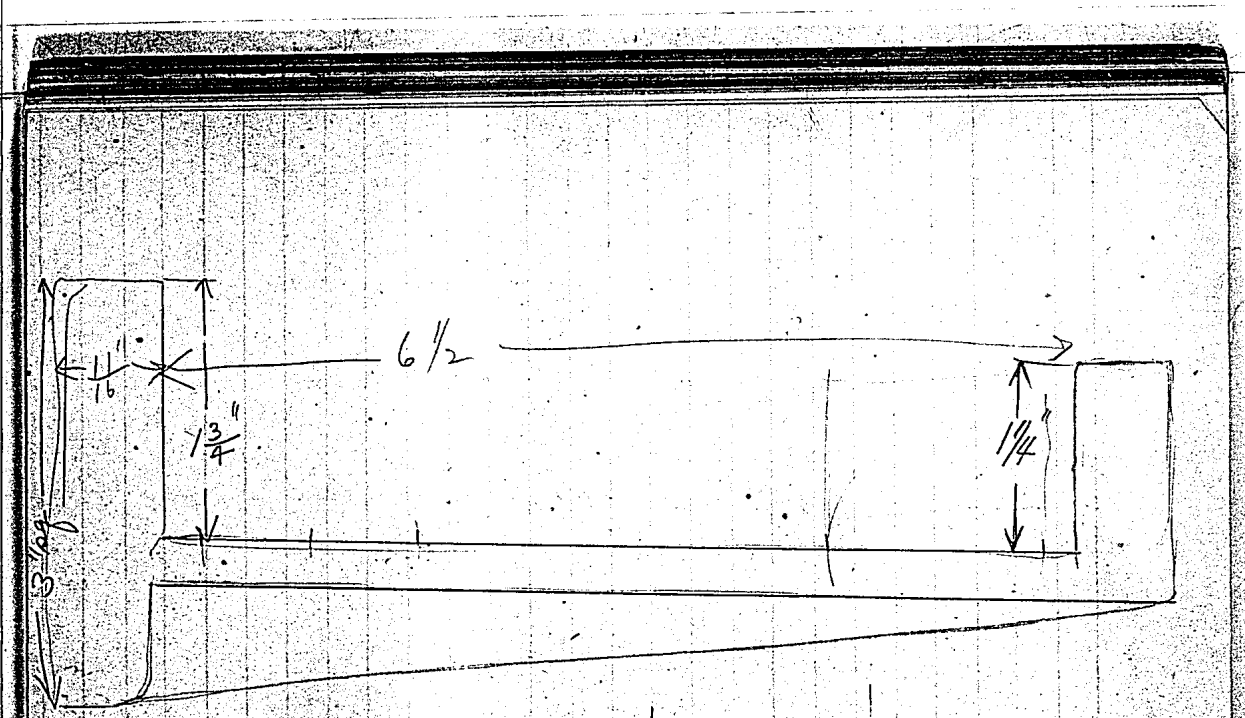






#3300

Fri. Jan. 2, 1914.



3300

Last Jan. 3, 1914.

C1153